IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of:	Gregory S. GLENN	:	Confirmation No.: 8302
Application No.:	10/677,191	:	Group Art Unit: 1753
Filed:	October 2, 2003	:	Examiner: Thanh-Truc TRINH

For: SOLAR CELL STRUCTURE WITH INTEGRATED DISCRETE BY-PASS DIODE

APPEAL BRIEF

MAIL STOP APPEAL BRIEF-PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Appellants file this Appeal Brief with the requisite fee. This Appeal Brief is due on January 26, 2008, which is a Saturday in the District of Columbia, and therefore is submitted on January 28, 2008. A Notice of Appeal and the requisite fee was previously filed.

REAL PARTY IN INTEREST

The real party in interest is The Boeing Company, Seattle, Washington.

RELATED APPEALS AND INTERFERENCES

Appellants are not aware of any related appeals and/or interferences.

STATUS OF CLAIMS

Claims 1-20 were originally filed. During prosecution, claims 1, 4, 11, 13 and 16 were amended. Claim 21 was added. Claims 1-21 are pending and all claims are finally rejected. Applicant appeals from the final rejection of claims 1-21 of the Final Office Action mailed August 24, 2007 and the Advisory Action of October 10, 2007, (hereinafter "Final Office Action" and "Advisory Action" respectively).

The appealed claims are set forth in Appendix I.

STATUS OF AMENDMENTS

All amendments to the claims were filed in an Office Action before final rejection, so all claim amendments have been entered. The Final Office Action and the Advisory Action reflects the amendments entered for purposes of appeal and the Advisory Action reflects the grounds of rejection of claims 1-21. No claims are allowed.

SUMMARY OF CLAIMED SUBJECT MATTER

Claims 1, 11 and 16 are independent; no means plus function claims are present in the application. Claims 11 and 16 are two different embodiments of generic claim 1. The following summary is provided with reference to the page and line number and/or Figures of the substitute specification submitted with the Application as originally filed.

Claim 1 is directed to a solar cell structure (Figure 1, page 3, lines 6-15, and page 6, lines 16-17) comprising a heat sink, a solar cell having a front side, a back side and a solar-cell projected area coverage on the heat sink. The solar cell comprises an active semiconductor structure that produces a voltage between the front side and the back side when the front side is illuminated. The solar cell includes a back side metallization. An intermediate structure is disposed between and joined to the back-side metallization of the solar cell and to the heat sink. This intermediate structure also has projected area coverage on the heat sink. (Projected area coverage is shown in Figure 5 and explained at page 6, lines 19-32-page 7, lines 1-2). The intermediate structure also includes a by-pass diode, which also has a diode projected area coverage on the heat sink.

Claim 11 is directed to a solar cell similar to claim 1, but which further defines the intermediate structure. The intermediate structure includes a discrete by-pass diode and a substrate coplanar with the by-pass diode (Figure 1, page 7, lines 20-26, 28-29). The diode projected area coverage on the heat sink is a fraction of the overall intermediate structure projected area on the heat sink, while the overall intermediate structure projected area are not less than the projected area coverage of the heat sink (page 8, lines 2-7). An intra-unit electrical connection structure electrically interconnects the solar cell and the by-pass diode in an electrical anti-parallel relationship (page 9, lines 5-7).

Claim 16 is directed to a solar cell similar to claim 1, but which further defines the intermediate structure and distinguishes it from claim 11. The intermediate structure comprises a discrete by-pass diode whose projected area coverage on the heat sink is essentially the same as the intermediate structure projected area on the heat sink (Figures 6, 7, page 10, lines 1-3). Stated alternatively, the by-pass diode comprises the complete intermediate structure (page 10, lines 3-5). An intra-unit electrical connection structure electrically interconnects the solar cell and the by-pass diode in an electrical anti-parallel relationship (page 9, lines 5-7). The solar cell additionally includes a circuit electrical connection structure operable to electrically interconnect each of the solar cell unit structures in series (page 9, lines 17-27 and page 10, lines 21-31).

Claims 2-10 and claim 21 are dependent on claim 1. Claim 2 defines the projected area of the diode on the heat sink is less than that of the solar cell, and, the intermediate substrate and by-pass diode are coplanar (Figure 1, page 7, lines 28-29 and page 8, lines 3-7). Claim 3 is directed to an intermediate structure that includes in coplanar arrangement both a substrate and by-pass diode and wherein the intermediate projected area coverage is not less than the solar cell projected area coverage (page 8, lines 3-9). Claim 4 defines an intermediate structure having a notch that receives the by-pass diode (Figures 3 and 4, page 8, lines 20-21 and 24-25). Claim 5 specifies that the projected area coverage on the heat sink is not less than that of the solar cell (page 8, lines 3-7). Claim 6 adds the intra-unit electrical connection to the solar cell of claim 1 (Figure 7 and page 9, lines 5-8). Claim 7 specifies that the backside of the solar cell is substantially planar (Figure 1 and page 6 lines 8-10). Claim 8 specifies that the solar cell further includes a circuit connection to electrically interconnect each of the solar cell unit structures in

series (page 9, lines 21-24). Claim 9 is directed to the joint between the intermediate structure and the heat sink wherein the joint is a metallic trace that is deposited using a metal deposition technique onto a dielectric layer (page 7, lines 14-16). Claim 10 is directed to a joint between the intermediate structure and the heat sink wherein the joint comprises a PC board having a metal trace on a face thereof. (Figure 7 and page 10, lines 21-31). Claim 21 specifies that the by-pass diode is a discrete by-pass diode (page 7, lines20-25).

Claims 12-15 are dependent on claim 11. Claim 12 defines the intermediate substrate and by-pass diode as coplanar (Figure 1 and page 7, lines 28-29). Claim 13 specifies that the solar cell further includes a circuit connection to electrically interconnect each of the solar cell unit structures in series (page 9, lines 21-24). Claim 14 is directed to the joint between the intermediate structure and the heat sink wherein the joint is a metallic trace that is deposited using a metal deposition technique onto a dielectric layer (page 7, lines 14-16). Claim 15 is directed to a joint between the intermediate structure and the heat sink wherein the joint comprises a PC board having a metal trace on a face thereof. (Figure 7 and page 10, lines 21-31).

Claims 17-20 are dependent on claim 16. Claim 17 specifies that the intermediate structure projected area coverage on the heat sink is not less than the solar-cell projected area coverage (page 8, lines 3-7) Claim 18 defines the intermediate substrate and by-pass diode are coplanar (Figure 1 and page 7, lines 28-29). Claim 19 is directed to the joint between the intermediate structure and the heat sink, wherein the joint is a metallic trace deposited on a dielectric layer (page 7, lines 14-16). Claim 20 is directed to a joint between the intermediate structure and the heat sink wherein the joint comprises a PC board having a metal trace on a face thereof. (Figure 7 and page 10, lines 21-31).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Ground 1. Claims 1-15 and 21 are rejected under 35 U.S.C. §103(a) as being unpatentable by Glenn (U.S. Patent No. 6,313,396, hereinafter the '396 patent) in view of The '630 patent et al. (U.S. Patent No. 5,800,630, hereinafter the '630 patent).

Ground 2. Claims 1, 5-8 and 21 are rejected under 35 U.S.C. §103(a) as being unpatentable by The '051 patent et al. (U.S. Patent No. 4,577,051, hereinafter the '051 patent) in view of the '630 patent.

Ground 3. Claims 16-18 are rejected under 35 U.S.C. §103(a) as being unpatentable by the '051 patent in view of the '630 patent.

Ground 4. Claims 9-10 and19-20 are rejected under 35 U.S.C. (a) as being unpatentable by the '051 patent in view of the '630 patent and the '396 patent.

ARGUMENT

All grounds of rejection are based on 35 U.S.C. §103(a). The following principle of law applies to all §103(a) rejections. As stated by the Federal Circuit, "a proper analysis under 35 U.S.C. § 103 requires, *inter alia*, consideration of two factors: (1) whether the prior art would have suggested to those of ordinary skill in the art that they should make the claimed composition or device, or carry out the claimed process; and (2) whether the prior art would also have revealed that in so making or carrying out, those of ordinary skill would have a reasonable expectation of success." *In re Vaeck*, 947, F.2d 488, 493 (Fed. Cir. 1991). In addition, the prior art reference(s) must teach or suggest all of the claim limitations. The teaching or suggestion to combine and the reasonable expectation of success must both be found in the prior art, and not in Applicant's disclosure. *Id* at 493. *See also* MPEP 2142.

The factual inquires set forth in Graham v. John Deere Co., 383 U.S. 1, 148 IS{Q 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. §103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or Nonobviousness,

Ground 1

Claims 1-15 and 21

Independent claims 1 and 11 require a heat sink. The '396 patent is relied upon for teaching a heat sink, but in fact no heat sink is present.

The '396 patent does not teach a heat sink. The explanation of the rejection identifies element 20 of the '396 patent as a heat sink. Substrate 20 is in fact a substrate that is made of a dielectric (i.e., nonconducting) material, and is preferably a material such as Kapton film or glass fibers (col. 6, lines 31-44). Substrate 20 of the '396 patent cannot perform as a heat sink.

The Examiner expresses a misunderstanding of the function of the recited heat sink. Heat sinks are good conductors of heat, having good thermal conductivity, and accelerate the dissipation of heat as compared to a structure where there is no heat sink. Electrical nonconductors such as Kapton tend not to be good conductors of heat, do not conduct heat to any appreciable degree, and in fact are good thermal insulators, having low thermal conductivity. Had claim 1 recited an "insulator layer" rather than a "heat sink," then the substrate 20 of the '396 patent might provide the required teaching. However, as understood, it does not.

The Response to Arguments in the final office action asserts "as long as substrate 20 has one surface area for absorbing heat and other surface areas for dissipating heat, the Examiner believes that substrate 20 can perform as a heat sink." The Examiner has repeated this position in the Advisory Action. Applicant must respectfully disagree for several reasons.

First, this statement suggests that there is no such thing as solid insulation, because all solid insulation will also have one surface for absorbing heat and another surface for dissipating heat. The proper line of analysis is not geometry, but instead is whether the thermal conductivity of the heat-sink material is high so that it accelerates heat conduction, or low, so that it inhibits heat conduction. A material with high heat conductivity can be used as a heat sink, while a material with low heat conductivity can be used as an insulator. Glass and Kapton, as taught by the '396 patent, are of low thermal conductivity and are therefore insulators.

Second, those skilled in the art recognize both glass fibers and Kapton as insulators. Applicant submits herewith several evidentiary exhibits on the point.

Exhibit 1 is part of The History of Spacesuits. As discussed in the very last sentence, speaking of the boots worn by those walking on the moon, who certainly did not want cold feet,

> "The boot inner layers were made from Teflon-coated glass-fiber cloth followed by 25 alternating layers of Kapton film and glass-fiber cloth to form an efficient, lightweight thermal insulation."

Both of the materials referenced by the '396 patent for use as the substrate 20 are identified as insulators.

Exhibit 2 is an excerpt from U.S. Patent 6,993,927, which at col. 4, line -col. 5, line 25 discusses thermal insulation, specifically mentioning Kapton as a good material for use in thermal insulator.

Exhibit 3 is a printout from the website of Dass & Company, which discusses as one of its product Thermal Insulation Material, specifically Kapton.

The Owens Corning website describes Owens Corning as the inventor of *glass fiber insulation* (emphasis added), including PINK insulation products.

Applicant has submitted each of these references to rebut the Examiner's position by showing that those skilled in the art understand that glass and Kapton are materials of low thermal conductivity and function as insulators, not as heat sinks. The Examiner dismisses the non-patent exhibits as irrelevant, and dismisses the patent reference U.S. Patent No. 6,993,927 (the '927 patent) which applicants submitted to show that materials of low thermal conductivity function as insulators. Instead, the Examiner without good explanation in the Advisory Action, indicates that the materials in the '927 patent can withstand high temperatures. Apparently, the Examiner is strongly suggesting that because a material can withstand a high temperature, it has thermal conductivity sufficient to qualify it as a heat sink. Such suggestion is not only unfounded, but it is wrong.

First, the above references are submitted to show that those skilled in the art understand that glass and Kapton are materials of low thermal conductivity and function as insulators, not as heat sinks. Second, thermal conductivity is a physical property of a material that is different from its melting temperature, or ability to withstand a high temperature, just as magnetism and vaporization temperature are different properties. In other words, just because a material can survive at an elevated temperature does not mean that it has high thermal conductivity.

The Examiner further asserts that nothing in the claims recites that a heat sink has to be a "good conductor of heat and accelerate the dissipation of heat" as argued by the Examiner. While this statement is true, these further recitations have not been included in the claims because Applicant understands the level of skill in the art as explained above, which is that only materials that are good conductors of heat and accelerate the dissipation of heat are used by the art as heat sinks. Applicant notes that, in fact, the Examiner is suggesting that a poor conductor of heat should be used as a heat sink, which is contrary to what one skilled in the art would use. Applicant notes that heat sinks are described in his specification at page 5, lines 25-28 through page 6, lines 1-5.

To further illustrate the level of skill in the art and what one skilled in the art would recognize as a heat sink and how a heat sink operates, Applicant refers to U.S. Patent No. 5,428,568 ('568 patent). At column 7, lines 60-65, the equation setting forth the heat conductivity of a heat sink is set forth.

$$Q2 == \lambda * A2(T1-T0)/l$$

where Q2 is the amount of heat transfer, l is the length of the heat sink, A2 is the cross-sectional area of the heat sink and λ is the heat conductivity (also known as thermal conductivity) of the heat sink. As can be seen from the equation and by one skilled in the art, the higher the thermal conductivity, the more effective the heat sink is in removing heat. At column 8, lines 4-8 of the '568 patent, the thermal conductivity of copper is identified at 400 W/mk. By contrast, the thermal conductivity of Kapton is 0.12 W/mk as indicated by the technical data sheet for Kapton, a copy of which is provided. Thus, the thermal conductivity of Kapton is about 1/4000 that of copper, and one skilled in the art would select the material with a high thermal conductivity for a heat sink.

The technical world recognizes Kapton and glass fiber as insulators, not heat sink material. One uses Kapton and glass fibers if one wants to inhibit heat flow and heat loss, not accelerate it as in a heat sink. Certainly with reference to the heat conductivity equation set forth in the '568 patent, one not skilled in the art could conceivably argue, which the Examiner has done, that Kapton could be used as a heat sink. However, the test set forth by Graham is to resolve the level of ordinary skill in the art, and one of ordinary skill in the art, based on the above discussion, would not consider using Kapton as a heat sink.

Applicant submits that the '396 patent does not disclose the limitations of claim independent claims 1 and 11, and dependent claims 2-10, 12-15 and 21. .

Ground 2

Claims 1, 5-8 and 21

Claims 1, 5-8, and 21 are rejected under 35 U.S.C. §103 over the '051 patent in view of the '630 patent. The Examiner's position is set forth in the final office action in which he asserts that the '051 patent teaches a heat sink and the intermediate structure projected area coverage on the heat sink is not less than the solar cell projected coverage on the heat sink. The Examiner reiterated in the Advisory Action that the non-conductive reinforcing tape 22 is in fact a heat sink and will function as a heat sink, even if it is a material of low heat conductivity. As applicant has noted in the argument to Ground 1, the heat conductivity, or thermal conductivity of a material, is crucial in determining whether a material can function effectively as a heat sink. That discussion is incorporated herein by reference. Once again, the Examiner's arguments are contrary to what one skilled in the art would recognize as an effective material for a heat sink. Again, the test set forth by Graham is to resolve the level of ordinary skill in the art, and one of ordinary skill in the art, based on the above discussion, would not consider using a material of low heat conductivity as a heat sink. With regard to the Examiner's assertion that a dielectric substrate having a metallic trace is in fact a PC board, the Examiner is once again either intentionally misstating what Applicant regards as his invention or does not understand the difference between a PC board and a metallic trace applied to a dielectric substrate. The logic is erroneous. The premise is all PC boards are comprised of dielectric materials and include a metallic trace (Applicant does not know if this premise is correct); therefore all dielectric substrates having a metallic trace are PC boards. This logic is erroneous.

Applicant traversed this ground of rejection in the response to the Final Office Action. There is nothing in the Advisory Action to change Applicant's position.

MPEP 2142, under ESTABLISHING A PRIMA FACIE CASE OF OBVIOUSNESS, provides: "To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. [citations omitted]. *See* MPEP para 2143-2143.03 for decisions pertinent to each of these criteria."

First requirement--there must be an objective basis for modifying or combining the teachings of the references.

The first of the requirements of MPEP 2142 is that "there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings." The present rejection is a §103 combination rejection. To reach a proper teaching of an article or process through a combination of references, there must be stated an objective motivation to combine the teachings of the references, not a hindsight rationalization in light of the disclosure of the specification being examined. MPEP 2142, 2143 and 2143.01. *See also*, for example, In re Fine, 5 USPQ2d 1596, 1598 (at headnote 1) (Fed.Cir. 1988), In re Laskowski, 10 USPQ2d 1397, 1398 (Fed.Cir. 1989), W.L. Gore & Associates v. Garlock, Inc., 220 USPQ 303, 311-313 (Fed. Cir., 1983), and Ex parte Levengood, 28 USPQ2d 1300 (Board of Appeals and Interferences, 1993); Ex parte Chicago Rawhide Manufacturing Co., 223 USPQ 351 (Board of Appeals 1984). As stated in In re Fine at 5 USPQ2d 1598:

> "The PTO has the burden under §103 to establish a prima facie case of obviousness. [citation omitted] It can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references."

And, at 5 USPQ2d 1600:

> "One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention."

Following this authority, the MPEP states that the examiner must provide such an objective basis for combining the teachings of the applied prior art. In constructing such rejections, MPEP 2143.01 provides specific instructions as to what must be shown in order to extract specific teachings from the individual references:

> "Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention when there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992)."

* * * * *

"The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." In re Mills, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990)."

* * * * *

"A statement that modifications of the prior art to meet the claimed invention would have been 'well within the ordinary skill of the art at the time the claimed invention was made' because the references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a prima facie case of obviousness without some objective reason to combine the teachings of the references. Ex parte Levengood, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993)."

There is set forth no objective basis for combining the teachings of the references in the manner used by this rejection, and selecting the helpful portions from each reference while ignoring the unhelpful portions. An objective basis is one set forth in the art or which can be established by a declaration, not one that can be developed in light of the present disclosure.

In this case, it is argued that the teaching of the '630 patent is to be combined with that of the '051 patent because "it would give a low resistance back contact." (Final Office Action, page 8, lines 15-19.) There is no reason to believe that the '051 patent's depicted structure does not already provide a "low resistance back contact." The '051 patent presumably provides a fully operational solar cell. It is additionally argued that the basis for the combination of teachings is "conventional use." This is a variation of a "well known" argument. "Well known" and "commonly known" are not classes of statutory prior art recognized in 35 USC 102 or 35 USC 103. Applicant traverses this substitution of asserted "well known" prior art for a statutory prior art reference as applied in the context of the claim. Here, the matters asserted to be "well known" are not, in this context. Applicant requests that, if the rejection is maintained, the Examiner apply a statutory prior art reference and set forth a rejection that incorporates the statutory prior art, to the extent that it is different from the '630 patent . MPEP 2144.03. If the asserted limitations are in fact well known, it should present no obstacle for the Examiner to cite and apply an appropriate statutory prior art reference. Absent such an application of statutory prior art in the statement of the rejection, Applicant requests that the rejection be withdrawn.

Applicant further requested that the Examiner set forth the objective basis found in the references themselves for combining the teachings of the references, and for adopting only the helpful teachings of each reference and disregarding the unhelpful teachings of the reference. Thus, as it stands now, the invention as a whole is not prima facie obvious over the combined teachings of the prior art. This objective basis was not provided.

Second requirement--there must be an expectation of success.

The second of the requirements of MPEP 2142 is an expectation of success. There is no expectation of success...This requirement has not been addressed in the explanation of the rejection, and in any event more than Examiner's argument is required here. The proposed modification cannot render the reference inoperable or unsatisfactory for its intended purpose, MPEP 2142, 2143.01, and MPEP 2143.02.

As stated in MPEP 2142, "The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. [citations omitted]."

This requirement is not addressed in the explanation of the rejection in the Final Office action or in the Advisory Action.

Third requirement--the prior art must teach the claim limitations.

The third of the requirements of MPEP 2142 is that "the prior art reference (or references when combined) must teach or suggest all the claim limitations." In this regard, the following principle of law applies to all §103 rejections. MPEP 2143.03 provides "To establish prima facie obviousness of a claimed invention, all claim limitations must be taught or suggested by the prior art. In re Royka, 490 F2d 981, 180 USPQ 580 (CCPA 1974). All words in a claim must be considered in judging the patentability of that claim against the prior art. In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970)." [emphasis added] That is, to have any expectation of rejecting the claims over a single reference or a combination of references, each limitation must be taught somewhere in the applied prior art. If limitations are not found in any of the applied prior art, the rejection cannot stand. In this case, the applied prior art references clearly do not arguably teach some limitations of the claims.

This analysis is conducted mindful of the legal standard for a §103 rejection. Graham v. John Deere, 148 USPQ 459 (Sup. Ct., 1966) requires the following steps: (1) determine the scope and content of the prior art; (2) ascertain the differences between the prior art and the

claims at issue; and (3) assess the level of skill in the art. Obviousness is determined against this background.

In determining obviousness, MPEP 706.02(j) requires (a) a statement of the relevant teachings of the prior art relied upon, preferably with reference to the relevant column or page number(s) and line number(s) where appropriate, (b) a statement of the differences in the claim over the applied references; (c) the proposed modifications to the art reference to arrive at the claimed subject matter; and (d) an explanation why one of ordinary skill in the art at the time the invention was made would have been motivated to make the proposed modification.

Claim 1 recites in part:

"a heat sink"

The '051 patent does not teach a heat sink. The explanation of the rejection identifies element 22 of the '051 patent as a heat sink. Element 22 of the '051 patent is in fact a piece of "non-conductive reinforcing tape 22" such as "an adhesive backed polymer tape." The reinforcing tape 22 does not perform as a heat sink.

Heat sinks are good conductors of heat and accelerate the dissipation of heat as compared to a structure where there is no heat sink. Nonconductors such as reinforcing tape 22 do not conduct heat to any appreciable degree, and in fact are good insulators. Had claim 1 recited an "insulator layer" rather than a "heat sink," then the reinforcing tape 22 of Harman might provide the required teaching.

As discussed in relation to the Ground 1 rejection, nonconducting materials are not good heat sinks, and one skilled in the art would not select a material with a low thermal conductivity as a heat sink without some additional motivation, which has not been provided.

The '630 patent has no relevant teaching.

The combination of the two references therefore cannot teach the limitations of claim 1.

Claims 5-8 and 21 depend from claim 1 and incorporate its limitations. They are therefore allowable over this rejection.

Additionally, claim 5 recites in part: "the intermediate-structure projected area coverage on the heat sink is not less than the solar-cell projected area coverage on the heat sink." The explanation of the rejection relies on Figures 1-2 of the '051 patent. Figures 1-2 of the '051 patent do not even show the relevant features in the pertinent view. The plan view of Figure 1 does not show the solar cell 16 at all. As discussed in relation to the Ground 1 rejection of claim

1, one cannot tell about the projected area from a side view such as Figure 2 of the '051 patent, because it does not show the third dimension. In fact, one must look to Figure 3 of the '051 patent to see the relative projected areas. As shown in Figure 3, the projected area of the solar cells is much, much larger than the projected areas of the intermediate structure as identified by the Examiner.

Claim 6 recites in part: "an intra-unit electrical connection structure operable to electrically interconnect the solar cell and the by-pass diode in an electrical anti-parallel relation." The '051 patent has no such teaching of an "anti-parallel" interconnection at col. 4, lines 43-58 or elsewhere.

Clam 8 recites in part: "a circuit electrical connection structure operable to electrically interconnect each of the solar cell unit structures in series." Although col. 5 lines 25-27 of the '051 patent state that twelve solar cells 16 were connected in series, there is no teaching of how that series connection was accomplished. Figures 1-3 certainly do not depict a series connection of the solar cells.

The rejection of claims 1, 5-8 and 21 on the grounds set forth by the Examiner should not be maintained.

Ground 3

Claims 16-18

Claims 16-18 are rejected under 35 U.S.C. §103(a) as being unpatentable by the '051 patent in view of the '630 patent. The Examiner indicates that claims 9 and 19 disclose a solar cell structure as described in claims 1 and 16. The '051 patent also describes a joint (20) between the intermediate structure and the heat sink. (22). The joint (or diagonal arm 20) is made of very thin copper. Therefore, it is the Examiner's position that a very thin copper joint is a metallic trace. The Examiner acknowledges that neither the '051 patent nor the '630 patent teach a metallic trace deposited upon a dielectric. The Examiner asserts that the '396 patent teaches a metal trace (19 and 17) deposited upon a dielectric layer. In the Advisory Action, the Examiner continues to assert that the "non-conductive reinforcing tape 22" of Hartman is a heat sink.

This was addressed in the arguments of Ground 1 and Ground 2 above, and those arguments are incorporated herein by reference. A "non-conductive reinforcing tape" either electrically or thermally, teaches directly away from what Applicant claims, and the Examiner

cannot incorporate an interpretation of a "non-conductive reinforcing tape 22" that is contrary to what those skilled in the art would understand a non-conductive reinforcing tape to be.

Claim 16 recites in part: "a heat sink." As noted, neither reference teaches a heat sink.

Claim 16 further recites in part: "the solar cell includes a back-side metallization at the back side." Neither reference teaches this limitation. The '051 patent does not teach a metallization at the back side. The '051 patent teaches that the back of the solar cell is defined by a substrate 15. The '630 patent teaches a structure that is contrary to teaching of the '051 patent that the back side of the solar cell is defined by the substrate 15. In design of the '630 patent, the back side is formed below the substrate 112. A person skilled in the art, who does not have the benefit of the present disclosure, would not know whether to put the substrate as the back side, as in Hartman, or the metallization as the back side, as in the '630 patent.

Claim 16 further recites in part: "an intra-unit electrical connection structure operable to electrically interconnect the solar cell and the by-pass diode in an electrical anti-parallel relation." The '051 patent has no such teaching of an "anti-parallel" interconnection at col. 4, lines 43-58 or elsewhere.

Claim 16 further recites in part: "a circuit electrical connection structure operable to electrically interconnect each of the solar cell unit structures in series." Although it discusses series interconnection, the '051 patent certainly does not teach how solar cells may be interconnected in series with its other structure. The '630 patent has no teaching of interconnection.

Claims 16-18 are therefore not taught by the combination of teachings of the references.

Additionally, claim 17 recites in part: "the intermediate-structure projected area coverage on the heat sink is not less than the solar-cell projected area coverage on the heat sink." The explanation of the rejection relies on Figures 1-2 of the '051 patent. Figures 1-2 of the '051 patent do not even show the relevant features in the pertinent view. The plan view of Figure 1 does not show the solar cell 16 at all. As discussed in relation to the Ground 1 rejection of claim 1, one cannot tell about the projected area from a side view such as Figure 2 of the '051 patent, because it does not show the third dimension. In fact, one must look to Figure 3 of the '051 patent to see the relative projected areas. As shown in Figure 3, the projected area of the solar cells is much, much larger than the projected areas of the intermediate structure as identified by the Examiner.

The rejection of claims 16-18 on the grounds set forth by the Examiner should not be maintained.

Ground 4

Claims 9-10, and 19-20

Claims 16-18 are rejected under 35 U.S.C. §103(a) as being unpatentable by the '051 patent in view of the '630 patent and are further in view of the '396 patent. The Examiner states that the '051 patent and the '630 patent disclose a solar cell as described in claims 1 and 16. Neither the '051 patent nor the '396 patent disclose a metallic trace deposited upon a dielectric. The Examiner maintains that Glenn teaches a metal trace deposited upon a dielectric layer 18.

Applicant has already discussed in the arguments of Ground 2 and Ground 3 that neither the '051 reference nor the '630 reference disclose the solar cell described in claims 1 and 16, and those arguments are incorporated herein by reference. The Examiner further displays a lack of understanding of what is meant by depositing a metallic trace, as that term is used and understood by those skilled in the art. In the Final Office Action, the Examiner referred to col. 5, lines 24-26 of the '396 patent, and in the Advisory Action, the Examiner referred to col. 6, lines 8-10 and lines 31-33 as teaching deposition of a metallic trace. In fact, the Examiner further states that "Glenn describes the metal traces 19 may be made by adhering a sheet of metal to substrate 20." The Examiner either does not understand the difference between joining two different materials using an adhesive or is intentionally mischaracterizing the description of the adhesion of a metal sheet to the substrate using a bonding element or adhesive. Applicant utilizes the term "depositing" as that term is understood by those in the art. Beyond that, the Applicant indicates at page 7, lines 3-19 what the term "depositing" means, and illustrates the difference between depositing and adhering. With regard to the Examiner's assertion that the claim includes a process limitation, Applicant respectfully responds that the element described is a "product by process," and is used to distinguish over different forms of the metallic trace as described at page 7 of Applicant's specification.

Applicant responded to the rejection of claims 9-10 and 19-20 in its response to the final office action, and the Advisory Action adds nothing to change Applicant's position. The Applicant stated as follows:

First requirement--there must be an objective basis for modifying or combining the teachings of the references.

Additionally, it is difficult to see any basis for combining the teachings of Glenn with those of Hartman. The use of the diode tape 10 of Hartman requires access to the back side of the solar cell, but the back side of the solar cell in the structure taught by Glenn is not accessible because of the other structure taught by Glenn, *see* for example the structure shown in Figure 1.

Second requirement--there must be an expectation of success.

Applicant incorporates the discussion of this requirement from the discussion of the Ground 2 and Ground 3 rejections.

The diode tape 10 of Hartman requires access to the back side of the solar cell, but the back side of the solar cell in the structure taught by Glenn is not accessible because of the other structure taught by Glenn, *see* for example the structure shown in Figure 1 of Glenn. Applicant can see no basis for an expectation of success in combining the teachings of Hartman and Glenn.

This requirement is not addressed at all in the explanation of the rejection.

Third requirement--the prior art must teach the claim limitations.

Claims 9 and 10 depend from claim 1, and incorporate its limitations. The limitations of claim 1 are not taught by these three references for the reasons stated in the responses to the Grounds 1-3 rejections, which are incorporated here.

Additionally, claim 9 recites, "the solar cell structure includes a joint between the intermediate structure and the heat sink, and wherein the joint comprises a metallic trace deposited upon a dielectric layer." The explanation of the rejection asserts that the elements 17 and 19 constitute the recited metallic trace, and that the bonding element 18 constitutes the dielectric layer. The explanation of the rejection references Figure 1 and col. 5, lines 24-26 of Glenn. Neither of these locations suggests that the metal trace 19 and the conducting element 17 are deposited upon the dielectric 18.

Claim 10 recites "the joint comprises a PC board having a metal trace on a face thereof." The explanation of the rejection references Figure 1, and the same elements 17, 18, and 19 are

discussed in relation to claim 9. There is no teaching that any of these elements is a PC (printed circuit) board. The explanation of the rejection asserts that "the structure of the joint is indistinguishable to a PC board having a metal trace on a face..." Applicant must respectfully disagree. A PC board is a specific structure. If the rejection is maintained, the Examiner must establish by evidence that the structure taught by Glenn is "indistinguishable" from a PC board.

Claims 19 and 20 depend from claim 16, and incorporate its limitations. The limitations of claim 1 are not taught by these three references for the reasons stated in the response to the Ground 3 rejections, which are incorporated here.

Additionally, claim 19 recites, "the solar cell structure includes a joint between the intermediate structure and the heat sink, and wherein the joint comprises a metallic trace deposited upon a dielectric layer." The explanation of the rejection asserts that the elements 17 and 19 constitute the recited metallic trace, and that the bonding element 18 constitutes the dielectric layer. The explanation of the rejection references Figure 1 and col. 5, lines 24-26 of Glenn. Neither of these locations suggests that the metal trace 19 and the conducting element 17 are deposited upon the dielectric 18.

Claim 20 recites "the joint comprises a PC board having a metal trace on a face thereof." The explanation of the rejection references Figure 1, and the same elements 17, 18, and 19 are discussed in relation to claim 9. There is no teaching that any of these elements is a PC (printed circuit) board. The explanation of the rejection asserts that "the structure of the joint is indistinguishable to a PC board having a metal trace on a face..." Applicant must respectfully disagree. A PC board is a specific structure. If the rejection is maintained, the Examiner must establish by evidence that the structure taught by Glenn is "indistinguishable" from a PC board.

The rejection of claims 9-10 and 19—20 on the grounds set forth by the Examiner should not be maintained.

SUMMARY AND CONCLUSION

Applicant asks that the Board reverse the rejections.

The Commissioner is authorized to charge any fees determined to be due to the undersigned's Account No. 50-1059.

Respectfully submitted,

Dated: January 28, 2008

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APPENDIX I

Copy of Claims Involved in the Appeal

1. A solar cell structure having a solar cell unit structure comprising:

a heat sink;

a solar cell having a front side, a back side, and a solar-cell projected area coverage on the heat sink, wherein the solar cell comprises an active semiconductor structure that produces a voltage between the front side and the back side when the front side is illuminated, wherein the solar cell includes a back-side metallization at the back side; and

an intermediate structure disposed between and joined to the back-side metallization of the solar cell and to the heat sink, and having an intermediate-structure projected area coverage on the heat sink, wherein the intermediate structure comprises

a by-pass diode having a diode projected area coverage on the heat sink.

2. The solar cell structure of claim 1, wherein the diode projected area coverage on the heat sink is less than the solar-cell projected area coverage on the heat sink, and wherein the intermediate structure further comprises

a substrate coplanar with the by-pass diode.

3. The solar cell structure of claim 1, wherein the diode projected area coverage on the heat sink is less than the solar-cell projected area coverage on the heat sink, and wherein the intermediate structure further comprises

a substrate coplanar with the by-pass diode and having a substrate projected area coverage on the heat sink such that the diode projected area coverage on the heat sink and the substrate projected area coverage on the heat sink taken together are not less than the solar-cell projected area coverage on the heat sink.

4. The solar cell structure of claim 1, wherein the diode projected area coverage on the heat sink is less than the solar-cell projected area coverage on the heat sink, wherein the

intermediate structure further comprises a substrate coplanar with the by-pass diode, and wherein the substrate has a substrate notch cut therefrom, and wherein the by-pass diode is received into the substrate notch.

5. The solar cell structure of claim 1, wherein the intermediate-structure projected area coverage on the heat sink is not less than the solar-cell projected area coverage on the heat sink.

6. The solar cell structure of claim 1, further including

an intra-unit electrical connection structure operable to electrically interconnect the solar cell and the by-pass diode in an electrical anti-parallel relation.

7. The solar cell structure of claim 1, wherein the back side of the solar cell is substantially planar.

8. The solar cell structure of claim 1, wherein the solar cell structure includes at least one additional solar cell unit structure as set forth in claim 1, and further including

a circuit electrical connection structure operable to electrically interconnect each of the solar cell unit structures in series.

9. The solar cell structure of claim 1, wherein the solar cell structure includes a joint between the intermediate structure and the heat sink, and wherein the joint comprises a metallic trace deposited upon a dielectric layer.

10. The solar cell structure of claim 1, wherein the solar cell structure includes a joint between the intermediate structure and the heat sink, and wherein the joint comprises a PC board having a metal trace on a face thereof.

11. A solar cell structure having a solar cell unit structure comprising:

a heat sink;

a solar cell having a front side, a back side, and a solar-cell projected area coverage on the heat sink, wherein the solar cell comprises an active semiconductor structure that produces a voltage between the front side and the back side when the front side is illuminated, wherein the solar cell includes a back-side metallization at the back side;

an intermediate structure disposed between and joined to the back-side metallization of the solar cell and to the heat sink and having an intermediate-structure projected area coverage on the heat sink, wherein the intermediate structure comprises

a discrete by-pass diode having a diode projected area coverage on the heat sink that is less than the intermediate-structure projected area coverage on the heat sink, and

a substrate coplanar with the by-pass diode and having a substrate projected area coverage on the heat sink such that the diode projected area coverage on the heat sink and the substrate projected area coverage on the heat sink taken together are not less than the solar-cell projected area coverage on the heat sink; and

an intra-unit electrical connection structure operable to electrically interconnect the solar cell and the by-pass diode in an electrical anti-parallel relation.

12. The solar cell structure of claim 11, wherein the back side of the solar cell is substantially planar.

13. The solar cell structure of claim 11, wherein the solar cell structure includes at least one additional solar cell unit structure as set forth in claim 11, and further including

a circuit electrical connection structure operable to electrically interconnect each of the solar cell unit structures in series.

14. The solar cell structure of claim 11, wherein the solar cell structure includes a joint between the intermediate structure and the heat sink, and wherein the joint comprises a metallic trace deposited upon a dielectric layer.

15. The solar cell structure of claim 11, wherein the solar cell structure includes a joint between the intermediate structure and the heat sink, and wherein the joint comprises a PC board having a metal trace on a face thereof.

16. A solar cell structure having

at least two solar cell unit structures, each solar cell unit structure comprising:

a heat sink,

a solar cell having a front side, a back side, and a solar-cell projected area coverage on the heat sink, wherein the solar cell comprises an active semiconductor structure that produces a voltage between the front side and the back side when the front side is illuminated, wherein the solar cell includes a back-side metallization at the back side,

an intermediate structure disposed between and joined to the back-side metallization of the solar cell and to the heat sink and having an intermediate-structure projected area coverage on the heat sink, wherein the intermediate structure comprises

a by-pass diode having a diode projected area coverage on the heat sink that is substantially the same as the intermediate-structure projected area coverage on the heat sink, and

an intra-unit electrical connection structure operable to electrically interconnect the solar cell and the by-pass diode in an electrical anti-parallel relation; and

a circuit electrical connection structure operable to electrically interconnect each of the solar cell unit structures in series.

17. The solar cell structure of claim 16, wherein the intermediate-structure projected area coverage on the heat sink is not less than the solar-cell projected area coverage on the heat sink.

18. The solar cell structure of claim 16, wherein the back side of the solar cell is substantially planar.

19. The solar cell structure of claim 16, wherein the solar cell structure includes a joint between the intermediate structure and the heat sink, wherein the joint comprises a metallic trace deposited upon a dielectric layer, and wherein the circuit electrical connection structure is accomplished in part through the metallic trace.

20. The solar cell structure of claim 16, wherein the solar cell structure includes a joint between the intermediate structure and the heat sink, wherein the joint comprises a PC board having a metal trace on a face thereof, and wherein the circuit electrical connection structure is accomplished in part through the metallic trace.

21. The solar cell structure of claim 1, wherein the by-pass diode is a discrete by-pass diode.

APPENDIX II

Evidence Entered and Relied Upon in the Appeal

Appellant attaches U.S. Patent No. 5,428,961 as evidence of the level of skill in the art related to heat sinks and heat conductivity, as well as the heat conductivity of copper.

Appellant attaches Dupont's Technical Data Sheet for Kapton to show the heat conductivity of Kapton.

APPENDIX III

Related Proceedings

Appellants are not aware of any related proceedings.